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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/728,295	12/04/2003	Mohamed Y. Soliman	2003-IP-011150U1	7913

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ROBERT A. KENT
P.O. BOX 1431
DUNCAN, OK 73536

EXAMINER	
GEBRESILASSIE, KIBROM K	
ART UNIT	**PAPER NUMBER**
2128	

NOTIFICATION DATE	DELIVERY MODE
08/12/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ROBERT.KENT1@HALLIBURTON.COM
Tammy.Knight@Halliburton.com

Office Action Summary	Application No.	Applicant(s)	
	10/728,295	SOLIMAN ET AL.	
	Examiner	Art Unit	
	KIBROM GEBRESILASSIE	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 June 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This communication is responsive to amended application filed on 06/11/2010.

2. Claims 30 and 31 have been added. Claims 1-31 are presented for examination.

Compact Expedite Prosecution

3. The examiner has identified potentially novel material: incorporation of the subject matter of Figure 6 into the current claims. An updated search would be carried out.

Response to Arguments

4. Applicants' argument relates to art rejection is not persuasive.

a. Applicants argued:

> By contrast, in the claimed invention elasticity is considered. As a fracture is created, stress surrounding the fracture changes. The effect of multiple fractures is cumulative. The effect at any point depends, for example, on the dimensions and net pressure of each fracture as well as the distance from each of those fractures. This consideration of elasticity is shown, for example, when claim 1 requires, in part, "determining one or more geomechanical stresses induced by each fracture based on the dimensions and location of each fracture." The Office

It is noted that the features upon which applicant relies (i.e. elasticity) are not recited in the rejection claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims.

In any case, Perkins et al discloses "fracture volume due to elastic deflection is determined" (See: Col. 5 lines 2-3) and therefore elasticity is considered.

b. Applicants argued:

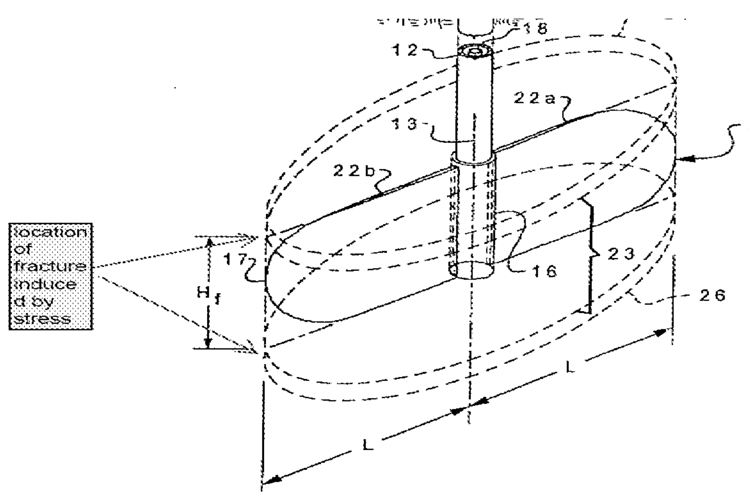
> Applicants respectfully disagree. Perkins states that "S_1 is the average opposing earth stress in the injection zone; and S_2 is the opposing earth stress in the top and/or bottom boundary zones." (Perkins, 4:1-4). Perkins's S1 and S2 are earth stresses and not stresses induced by each fracture as required by the claim. This is because Perkins's equation 1 determines the ratio H/H_f, where H_f is the fracture height and H is the high of the injection or disposal zone 23. Neither equation 1, nor any other discussion in Perkins discloses determining geomechanical stresses induced by each fracture, as required by this claim element.

Examiner respectfully disagrees. Perkins et al discloses "fracture is governed by the stress distribution" (See: Col. 6 lines 1-12).

c. Applicants argued:

> Furthermore, Perkins's equation 1 is not *based on the location of each fracture*, as required by the claim. Neither Perkins's equation 1, nor any other portion of Perkins discloses determining geomechanical stresses induced by each fracture *based on the location of each fracture*, as required by this claim element.

As indicated above, fractures are governed by stress distribution. Therefore, Fig. 1 illustrates the height (i.e. equivalent to location) between two fractures that are governed by stress distribution which are equivalent to the claimed invention.



Further, Figs 2 and 3 show the location of different fractures that are governed by stress distribution.

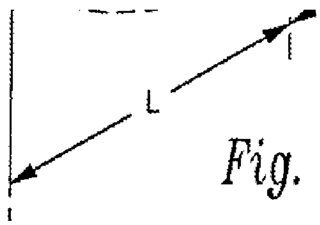


Fig. 1

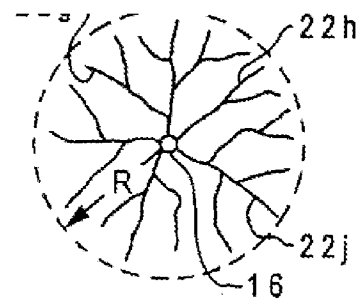


Fig. 2

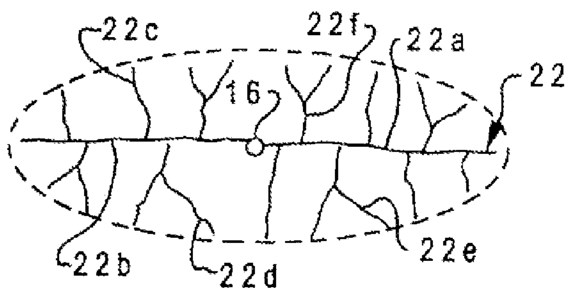


Fig. 3

d. Applicants argued:

> As discussed above, Perkins does not disclose determining stresses induced by each fracture. Similarly, Perkins does not disclose the determination of a predicted stress field as required by this claim element. Perkins's S1 and S2 are earth stresses and not stresses induced

Perkins et al discloses "fracture is governed by stress distribution" (See: Col. 6 lines 1-14).

e. Applicants argued:

> Furthermore, claim 4 further requires "spacing the fractures a uniform distance from each other." The Office action states that:
>
> > d. As per Claim 4, Perkins et al discloses the method according to claim 1, further comprising the step of spacing the fractures a uniform distance from each other (such as "fractures which extends equally in two directions"; See: Col. 6 lines 10-16).
>
> (Office action, 4)
>
> Applicants respectfully disagree. The cited portion of Perkins discusses the propagation

Examiner respectfully disagrees. Perkins et al discloses “planar fracture which extends equally in two directions" (See: Col. 6 lines 10-16). Further, in Fig. 1, the two fractures have uniform distance from each other based on the height.

f. Applicants argued:

> Furthermore, claim 6 further requires “creating one or more fractures in the subterranean formation and repeating steps (a), (b), and (c) after each fracture is created.” The Office action states that:
>
> > f. As per Claim 6, Perkins et al discloses the method according to claim 1, further comprising the steps of: creating one or more fractures in the subterranean formation; and repeating steps (a), (b), and (c) after each fracture is created (See: Col. 2 lines 3-13).
>
> (Office action, 4)
>
> Applicants disagree. As discussed above, Perkins does meet the claim limitation because it does not perform steps (a), (b), and (c) for the reasons presented above with respect to claim 1.

Examiner respectfully disagrees. Perkins et al discloses the determination of height, width and number of fracture using equations 1-9 to create a fracture as shown in Fig. 1. Fig. 1 clearly shows the formation one or more fractures wherein the fractures are defined by height, width and stress distribution.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1, 2, 4-6, 16-19, 21, 24, 25, and 27 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 5, 463, 164 issued to Perkins et al.

a. As per Claim 1, Perkins et al discloses a method of optimizing a number, placement and size of fractures in a subterranean formation (See: Equation 1, 2, and 9 the generation of # of fractures, height , radius and width) comprising the steps of:

(a) determining one or more geomechanical stresses induced by each fracture based on the dimensions and location of each fracture (such as “S1 and S2 of equation 1”; See: Co. 4 lines 1-22, equation 1, Col. 6 lines 10-12 “fracture is governed by the stress distribution”);

(b) determining a geomechanical maximum number of fractures based on the geomechanical stresses induced by each of the fractures (See: Equation 9 and claim 13);

(c) determining a predicted stress field based on the geomechanical stresses induced by each fracture (such as “S1 and S2 of equation 1”; See: Co. 4 lines 1-22, equation 1, Col. 6 lines 10-12 “fracture is governed by the stress distribution”); and

(d) generating an optimized number, placement and size for two or more fractures in subterranean, where generating the optimized number, placement and size for one or more fractures in a subterranean formation is based, at least in part (See: Equation 1, 2, and 9 the generation of # of fractures, height , radius and width), one or more of: the geomechanical maximum number of fractures; and the

predicted stress field based on the geomechanical stresses induced by each fracture (See: Equations 1, 2, and 9).

b. As per Claim 2, Perkins et al discloses the method according to claim 1, wherein steps (a), (b), and (c) are performed prior to creating any of the fractures in the subterranean formation (See: Col. 4 lines 9-22).

c. As per Claim 4, Perkins et al discloses the method according to claim 1, further comprising the step of spacing the fractures a uniform distance from each other (such as "fractures which extends equally in two directions”; See: Col. 6 lines 10-16).

d. As per Claim 5, Perkins et al discloses the method according to claim 1, further comprising the step of creating the fractures with a uniform size (such as "fractures which extends equally in two directions”; See: Col. 6 lines 10-16).

e. As per Claim 6, Perkins et al discloses the method according to claim 1, further comprising the steps of: creating one or more fractures in the subterranean formation; and repeating steps (a), (b), and (c) after each fracture is created (See: Col. 2 lines 3-13).

f. As per Claim 16, Perkins et al discloses the method according to claim 1, wherein the subterranean formation comprises a well bore comprising a generally vertical portion (See: Fig. 1).

g. As per Claim 17, Perkins et al discloses the method according to claim 16, wherein the well bore further comprises one or more laterals (such as “Lateral distance L”; See: Fig. 1).

h. As per Claims 18, 19, 21, 24, 25, and 27, the instant claim(s) recite(s) substantially same limitation as the above rejected claim(s) 1, 2, and 6, and therefore rejected under the same rationale.

i. As per claim 30, Perkins et al discloses the method of claim 1 wherein generating an optimized number, placement and size for two more fractures in a subterranean formation comprises: generating an optimized number, placement and size for three or more fractures in the subterranean formation (See: Equation 1, 2, and 9 the generation of # of fractures, height , radius and width).

j. As per claim 31, the instant claim(s) recite(s) substantially same limitation as the above rejected claim(s) 30, and therefore rejected under the same rationale.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claims 3, 20, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5, 463, 164 issued to Perkins et al as applied to claims above, and further in view of M. Y. Soliman, J. L. Hunt, and M. Azari, “Fracturing Horizontal Wells in Gas Reservoirs”, SPE 1999.

k. As per Claim 3, Perkin et al fails to disclose determining a cost-effective number of fractures; determining an optimum number of fractures, where the optimum number of fractures is the maximum cost-effective number of fractures that does not exceed the geomechanical maximum number of fractures.

Soliman et al discloses the method according to claim 1, further comprising the steps of: determining a cost-effective number of fractures (such as “Benefit/cost ratio vs. number of fractures"; See: Fig. 14); determining an optimum number of fractures, where the optimum number of fractures is the maximum cost-effective number of fractures that does not exceed the geomechanical maximum number of fractures (such as “Benefit/cost ratio vs. number of fractures"; See: Fig. 14).

It would have been obvious to one of ordinary skill in the art to combine the teaching of Soliman et al with the teaching of Perkins et al because both references drawn to hydraulic fractures. The motivation to include a cost effective number of fractures of Soliman et al to the teaching of Perkins et al would be to include the economic aspect with accurate estimation of well productivity for a given reservoir (Soliman et al).

l. As per Claim 20, and 26, the instant claim(s) recite(s) substantially same limitation as the above rejected claim(s) 3, and therefore rejected under the same rationale.

9. Claims 7-15, 22, 23, 28, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5, 463, 164 issued to Perkins et al as applied to claims above, and further in view of WO 01/81724 A1 issued to Wright et al.

m. As per Claim 7, Perkins et al fails to disclose gathering and analyzing real-time fracturing data for each fracture.

Wright et al discloses the method according to claim 6, wherein the repeating step comprises the steps of gathering and analyzing real-time fracturing data for each fracture (such as "fracture growth or other subsurface processes from the collected downhole tilt data versus time"; See: Abstract, pg. 20 lines 21-26).

It would have been obvious to combine the teaching of Wright et al with the teaching of Perkins et al because both references drawn to hydraulic fractures. The motivation to include a real-time analysis of Wright et al to the teaching of Perkins et al would be used to estimate the direction the orientation of a fracture which is created in the active well (Wright et al).

n. As per Claim 8, Wright et al discloses the method according to claim 7, wherein a well is placed in the subterranean formation, the well comprising a wellhead, a tubing, and a well bore, the well bore comprising a downhole section, and wherein the gathering of real-time fracturing data comprises the steps of: (i)

measuring a fracturing pressure while creating a current fracture; (ii) measuring a fracturing rate while creating the current fracture; and (iii) measuring a fracturing time while creating the current fracture (such as ”fracture growth or other subsurface processes from the collected downhole tilt data versus time”; See: Abstract, pg. 20 lines 21-26).

o. As per Claim 9, Wright et al discloses the method according to claim 8, wherein the measuring of fracturing pressure is accomplished using one or more transducers located at the wellhead (such as “provides data acquisition and analysis systems, to map the fracture height in real-time, additionally possible results of analysis of the data include interpretation of fracture width and length, as well as net fracture pressure"; See: pg. 20 lines 21-26).

p. As per Claim 10, Wright et al discloses the method of claim 8, wherein the measuring of fracturing pressure is accomplished using one or more transducers located down hole (such as “provides data acquisition and analysis systems, to map the fracture height in real-time, additionally possible results of analysis of the data include interpretation of fracture width and length, as well as net fracture pressure"; See: pg. 20 lines 21-26).

q. As per Claim 11, Wright et al discloses the method according to claim 8, wherein the fracturing pressure is measured in the tubing (such as “provides data acquisition and analysis systems, to map the fracture height in real-time, additionally possible results of analysis of the data include interpretation of

fracture width and length, as well as net fracture pressure"; See: pg. 20 lines 21-26).

r. As per Claim 12, Wright et al discloses the method according to claim 7, wherein analyzing of real-time fracturing data comprises the steps of: determining a new stress field, based on the real-time fracturing data; and comparing the new stress field with the predicted stress field (such as ”fracture growth or other subsurface processes from the collected downhole tilt data versus time”; See: Abstract, pg. 20 lines 21-26).

s. As per Claim 13, Wright et al discloses the method according to claim 12, further comprising the step of decreasing the number of 3fractures in response to the real-time fracturing data (such as “the fracture height growth in real-time” pg. 20 lines 21-26).

t. As per Claim 14, Wright et al discloses the method according to claim 12, further comprising the step of increasing the distance between the fractures in response to the real-time fracturing data (such as “the fracture height growth in real-time” pg. 20 lines 21-26).

u. As per Claim 15, Wright et al discloses the method according to claim 12, further comprising the step of adjusting the size of the fractures in response to the real-time fracturing data such as ”fracture growth or other subsurface processes from the collected downhole tilt data versus time”; See: Abstract, “the fracture height growth in real-time” pg. 20 lines 21-26).

v. As per Claims 22, 23, 28, and 29, the instant claim(s) recite(s) substantially same limitation as the above rejected claim(s) 7, and 12, and therefore rejected under the same rationale.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KIBROM GEBRESILASSIE whose telephone number is (571)272-8571. The examiner can normally be reached on Monday-Friday 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571)272-2279. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KIBROM GEBRESILASSIE/
Examiner, Art Unit 2128

/Hugh Jones/
Primary Examiner, Art Unit 2128